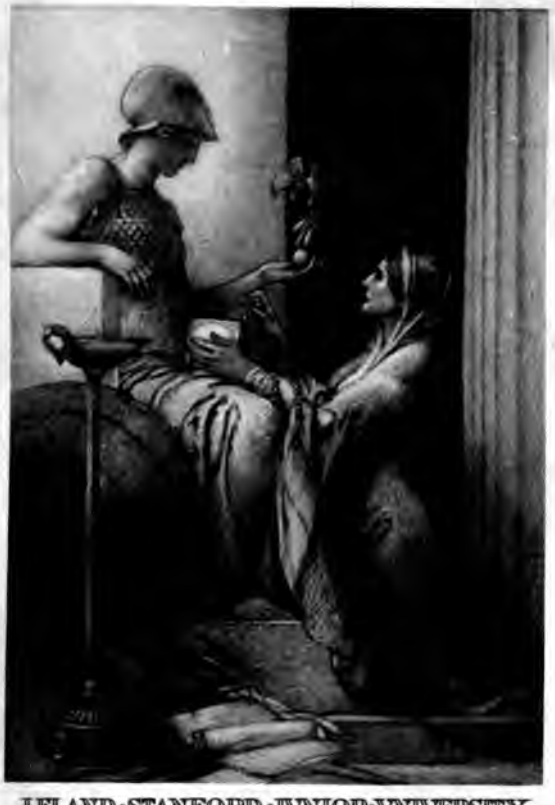
A. P. Coleman

The Melaphyres of Lower Silesia.

Breslau, 1882.



THE MELAPHYRES OF LOWER SILESIA.

INAUGURAL-DISSERTATION

FOR THE

DEGREE OF DOCTOR OF PHILOSOPHY

WHICH WITH APPROVAL OF THE

PHILOSOPHICAL FACULTY OF THE ROYAL UNIVERSITY OF BRESLAU

THE AUTHOR

ARTHUR P. COLEMAN

FROM COBOURG IN THE PROVINCE OF ONTARIO CANADA

WILL PUBLICLY DEFEND

IN THE AULA LEOPOLDINA

FRIDAY, THE 4TH. OF AUGUST AT 1 O'CLOCK P. M.

AGAINST THE OPPONENTS:

DR. HERMANN KUNISCH
ASSISTANT IN THE MINERALOGICAL MUSEUM

GUIDO BODLÄNDER
DRD. PHILOS.

ALBERT BEUTELL
CAND. RER. NAT.

BRESLAU 1882.

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DEDICATED

TO

DR. EUGEN HAANEL

PROFESSOR OF PHYSICS IN THE UNIVERSITY OF VICTORIA
COLLEGE, COBOURG, ONTARIO, CANADA

AS A SMALL TOKEN OF ADMIRATION AND AFFECTION

BY THE

AUTHOR.

§ 1.

The Melaphyres of Lower Silesia, as indicated on the Geological Map of the Province [1]), lie in two distinct regions, one southwest of Waldenburg, the other farther north near the town of Lähn between Hirschberg and Löwenberg.

In the first or Waldenburg region, Melaphyre in connection with Porphyry forms the northern and northeastern limit of the great Chalk Basin of North Bohemia. The neighboring sedimentary rocks belong usually to the Permian (Rothliegendes), more rarely to the Coal Formation.

The general direction of the Melaphyre is northwest and southeast except at Landeshut where a sharp elbow reaches south as far as Reichhennersdorf. Two large portions and several smaller ones are found in Bohemia far to the southwest. They lie on the western side of the Chalk Basin and are evidently to be considered a continuation of the main range beginning at Landeshut. The latter gradually widens as it runs southeast from Landeshut until between Friedland and Langwaltersdorf it is more than two km. wide; but at Görbersdorf it is nearly cut off by a projection of Permian toward the south. Beyond Görbersdorf it widens as suddenly to about three km., the greatest width of the whole range. It now changes its course and runs nearly east forming an oblong portion which is cut off almost in

[1]) Geologische Karte von dem niederschlesischen Gebirge und den angrenzenden Gegenden, mit Benutzung der Beobachtungen des Kgl. Berghauptmanns, Dr. von Carnall, bearbeitet von E. Beyrich, G. Rose, J. Roth, W. Runge (1841–60).

a straight line at Dreiwasser. After a short interruption a small extent of Melaphyre occurs at Lomnitz. Several small points are scattered to the north of this between Lomnitz and Waldenburg, and a strip near Gottesberg lies quite isolated. After an interruption of several km. Melaphyre occurs again at Johannisberg farther south and continues southwest mostly in Bohemia till Tunschendorf is reached. West of this there is a smaller strip running parallel to the main range from Vier Höfe southeast along the Bohemian frontier. There are several smaller portions south of Tunschendorf with their longest axis in the usual northeast and southwest direction. The series closes with an elongated strip including the villages Dürr Kunzendorf and Kamitz. An isolated point occurs somewhat out of the line at Hockenberg near Rothwaltersdorf.

The whole range is about 50 km. long. Landeshut lies at the northwest end, Waldenburg near the middle and Neurode near the southeast end.

The Melaphyre region near Lähn lies between Hirschberg and Löwenberg and forms several parallel ranges with a general direction from northwest to southeast. The neighboring rocks are chiefly Permian, to a less extent Azoic Schists. Porphyry comes in contact with Melaphyre only at one place, Rosenau near Schönau. The two southern ranges lie, in part at least, on the borders of a Chalk Basin, but their relations to it are not so distinct as in the Waldenburg region. A singularly long and narrow range lies to the southwest, with a single interruption at Hagendorf, running from Friedrich's Höhe to Husdorf near Lähn, a distance of about 16 Km.; while the width hardly ever reaches half a km. A similar range but only 4 km. long runs parallel to this at the north, and ceases abruptly on the left bank of the Bober just above Lähn. Two isolated points to the southeast are probably to be considered a continuation of it. The northern range is much broader and more irregular than the first two. It is cut up into island-like portions but in general runs parallel to the former

ones. It begins not far from Hagendorf, at first narrow but gradually widening to 2½ km. not far from Nieder Schmottseifen, then becoming irregular just before it is cut off by the Bober north of Merzdorf. It reappears at Dippelsdorf on the other side of the valley, reaches a width of about 2 km., and ends near Schönwaldau. Two large portions to the north are separated from it only by alluvium and should probably be reckoned with it. The isolated ridge at Hopfenberg near Hohenliebenthal may be considered a continuation toward the southeast. Three other small portions occur not far away at Rosenau near Schönau. Finally there is a narrow semicircular strip near Graditz and Ullersdorf 10 km. to the north and quite isolated from the rest. The whole region exclusive of the part last mentioned is about 30 km. in length.

§ 2.

Of the two Melaphyre regions outlined in the previous pages only the southern one near Waldenburg has been to any important extent investigated and described. The fine exposure of Melaphyre at Buchberg near Landeshut attracted the attention of Leopold von Buch as early as 1797 when he describes the hill as consisting of Basalt alternating with Mandelstein and passing into Greenstone. He wonders to find it so continuously and distinctly stratified and concludes from its appearance and from other considerations that Basalt is of Neptunian origin. He describes the rock as shimmering from finely disseminated particles of Hornblende and remarks the absence of Olivine, a mineral so characteristic of Basalt.[1]) Five years later his opinions have changed and he describes the rock as a fine grained Greenstone but thinks it doubtful if the name Basalt is not

[1]) Beschreibung des Buchbergs. Schlesische Provinzialblätter, Breslau 1797, p. 218, 219; also: Gesammelte Schriften, Berlin 1867, 1, 73, 223.

more appropriate. His account of the minerals contained in amygdules nnd fissures is quite complete.[1])

Karl von Raumer[2]) mentions this rock occasionally under the name Basaltite, treating of it in connection with Porphyry and Permian rocks. He considers Mandelstein (the amygdaloidal modification of Melaphyre) as a distinct rock.

The first work of much real importance however is from Zobel and von Carnall[3]) who cover much the same ground as von Raumer but much more thoroughly and reliably. Their account of Melaphyre is introduced by a discussion of the names it has received from various authors. Basaltite, Trapp, Augite Porphyry, Black Porphyry and other names are rejected as being vague or misleading, and the name Porphyrite is chosen, because the rock generally accompanies Porphyry and in the authors' opinion is connected with it by transitional forms. Zobel and von Carnall separate it however from the latter on account of the evenness of the mass, the absence of scattered crystals and the possession of a higher degree of toughness. They think it consists chiefly of Feldspar colored by oxides of iron, Hornblende and perhaps also Augite. Mandelstein is in their opinion simply Porphyrite modified by the presence of bubbles giving an opportunity to excrete an excess of silica. Their observations, though scattered on account of their method of survey, form even yet the most trustworthy guide in studying the Waldenburg Melaphyres. Their geological map is a great advance on any thing going before.

The work was continued by von Carnall alone in the following year.[4]) He considers the Porphyrite younger

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[1]) Geognostische Beobachtungen auf Reisen etc. 1802, **1**, 120; also: Gesammelte Schriften, 1867, **1**, 223.

[2]) Das Gebirge Niederschlesiens etc., 1819, 101.

[3]) Geognostische Beschreibung von einem Theil des Niederschlesischen, Glatzischen und Böhmischen Gebirges, Karstens Archiv, 1831, **8**, 284.

[4]) Geognostische Vergleichung zwischen den Nieder- und Oberschlesischen Gebirgsformationen etc., Karstens Archiv, 1832, **4**, 333.

than the Porphyry and thinks that where subordinate its eruptions have followed the way opened up by the Porphyry.

The work of Lüttke and Ludwig [1]) covers the northern Melaphyre region but adds very little to our knowledge of the Melaphyre itself. They describe the outcrop by the Bober at Lähn as a Mandelstein with a basis of Hornblende and Feldspar, while the amygdules an filled with fibrous Calcite, Barite and Brownspar. The rock is in their opinion probably related to the Clay Slate and should be separated from the Porphyry, which inclines more toward the Permian. A little further on they classify the rock with the Diorites since its components are of a recognizable size. After reading their work one is inclined to agree with them that „the region is worthy of a more special investigation."

A very brief but none the less important discussion of the relative ages of Melaphyre and Porphyry is given by E. Beyrich, [2]) in which he expresses the opinion that while observations on the Melaphyre north of the Riesengebirge show them to belong exclusively to the Permian and to be in every case younger than the Porphyry, there can be no doubt that in the Waldenburg region eruptions of Porphyry took place even in the upper layers of the Permian after the chief eruption of Melaphyre was already past; hence the relation of these two Plutonic rocks as to age is not constant.

A new stage in petrographic research is marked by the appearance of Jenzsch's microscopical and chemical investigation of Melaphyre from Hockenberg near Rothwaltersdorf, [3]) wherein a microscope plays a roll for the first time in the study of a Silesian Melaphyre. The results were

[1]) Geognostische Bemerkungen über die Gegend von Görrisseifen, Lähn etc., Karstens Archiv, 1838, **11**, 252.

[2]) Altersbeziehungen des Melaphyrs und rothen Porphyrs im Waldenburgischen. Zeitschrift der deutsch. geol. Ges., 1850, **2**, 266.

[3]) Mikroskopische und chemischanalytische Untersuchung des bisher für Melaphyr gehaltenen Gesteins vom Hockenberg bei Neurode. Pogg. Ann., 1855, **95**, 419.

however still very imperfect, since the characteristics of the various minerals under the microscope were only beginning to be known, and the now so indispensable polarizing apparatus had not yet been applied to the microscope. He, as Gustav Rose had previously done, recognized Feldspar, Pyroxene, Magnetite, Chlorophaeite and Apatite in the rock and supports the observations by a complicated reckoning from the accompanying chemical analysis. He concludes from the large amount of Silica and Potassium found that Labradorite cannot be an essential component of the rock and hence it is not really a Melaphyre.

A few years later Gustav Rose,[1]) who had examined sections from Buchberg and Hockenberg with the microscope, compares the Silesian Melaphyres with those from Ilfeld, Harz, and finds them much alike. The occasion for Rose's remarks was given by Streng's valuable publications on the Melaphyres of the Harz.[2])

The fullest and most formal account of Silesian Melaphyres that has yet appeared is that of von Richthofen[3]) who, in his discussion of Melaphyre in general, drew most of his material from Buchberg near Landeshut. Richthofen's historical and critical introduction though interesting has no special bearing on the present work, but other portions, such as his description of the course of decomposition in Melaphyre with the accompanying analyses, also the account of Amygdaloids (Mandelstein) from Buchberg are of direct importance. He unfortunately made no use of the microscope which was just then coming into favor with petrographers. He considers the rock a compound of Oligoclase and Hornblende, and believes that it is free from Augite and Olivine. His conclusions show how much even an experienced petrographer may go astray in his judgment of an

[1]) Bemerkungen über die Melaphyre genannten Gesteine von Ilfeld am Harz, Zeitschr. d. deutsch. geol. Gesellsch., 1859, **11**, 290.

[2]) Zeitschr. d. deutsch. geol. Ges. 1858, **10**, 99. 1859, **12**, 78.

[3]) Ueber den Melaphyr, Zeitschr. d. deutsch. geol. Ges. 1856, **8**, 589.

aphanitic rock when relying solely on the results of chemical analysis and observations with a hand lens.

J. Roth's explanatory text to the Lower Silesian Geological Map [1]) appeared in 1867, and in accordance with the character of the work, gives a condensed account of what was known of Melaphyres up to that time. A similar resumé is given two years later by G. Tschermak, [2]) who draws from the same sources as Roth. Other writers on the geology of Bohemia also give a few words here and there to the Melaphyres of the Waldenburg region; e. g. Jokely [3]) treats of the comparative ages of Melaphyre and Porphyry near Johannisberg; and E. Boricky has described several microscopical sections from the vicinity of Braunau. [4])

G. Haarmann [5]) in his inaugural dissertation on the subject of Melaphyre refers to the large amount of glass-basis contained in the rock from Buchberg and supports Jenzsch's view that the Melaphyre from Hockenberg is rich in Orthoclase.

F. Zirkel [6]) and H. Rosenbusch [7]) also refer occasionally to Silesian Melaphyres in their excellent and in fact indispensable works on microscopic petrography.

As far as the writer is aware, all important points in the somewhat scattered literature have been referred to in the brief historical sketch just given, showing how little has

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[1]) Erläuterungen zu der geognostischen Karte vom niederschlesischen Gebirge und den umliegenden Gegenden, mit einer Uebersichtskarte, Berlin 1867, 264, 344.

[2]) Porphyrgesteine Oesterreichs, Wien 1869, 71, 82.

[3]) Jahrb. der geol. Reichsanstalt, Wien. Verhdl. 1861, **12**, 172.

[4]) Petrographische Studien an den Melaphyrgesteinen Böhmens, Prag 1876, 51—52.

[5]) Mikroskopische Untersuchung über die Struktur etc. der Melaphyre, Zeitschr. der deutsch. geol. Ges. 1873, **25**, 440.

[6]) Mikroskopische Beschaffenheit der Mineralien und Gesteine, Leipzig 1873, 412.

[7]) Mikroskopische Physiographie der massigen Gesteine, Stuttgart 1877, 397.

been done or at least published on the subject, and h
much remains uninvestigated according to modern metho
From the important region near Lähn neither chemical a
alyses nor microscopic examinations are on record.

My attention was first directed to this subject by Pr
Dr. Liebisch. For this and for his very great kindness a
assistance in other respects it may be allowed me here
express my warmest and most appreciative thanks.

§ 3.
The Waldenburg Region.

The best known exposure of Melaphyre in this regi
is found at Buchberg near Landeshut where the Mumm
quarry affords an excellent opportunity to study the rocl

A glance at the lofty wall of rock shows two gr
layers of Melaphyre each covered by a considerable dep
of Mandelstein, and the latter in its turn by an earthy lay
much decayed but still showing in parts masses with t
look of a breccia. Richthofen seems to refer to this l
appearance when he speaks of a melting together of P
phyry and Melaphyre at Buchberg, each sending veins in
the other[1]); but the absence of Porphyry in the neighb
hood makes this doubtful. From the decayed state of t
masses it is hard to say what the rock originally was.
stratified look induced L. von Buch to refer it to a se
imentary origin;[2]) but in reality we see here two outflo
of once melted rock, one over the other, each with its lov
part solid, its upper porous from ascending bubbles, and
layer of slag and rubbish on top. The underlying rock
clay according to von Buch.

The amygdules have generally an outside layer of I
lessite often filled out with white soft Kaolin or nearly
often with Chalcedony, Quartz and Calcite.

The Melaphyre itself is fine grained, not particula
fresh, and greenish or reddish in color. Minute crystals

[1]) Zeitschr. d. deutsch. geol. Ges., 1856, 8, 654.
[2]) Schles. Prov.-Blätter, 1797, 221; Gesammelte Schriften 75.

Plagioclase and Olivine render it porphyric. Under the microscope it proves to be mostly composed of Plagioclase in small strips, jagged or toothed at the ends, or larger crystals with twin lamellae and occasionally a zonal structure. All transitions between the two extremes occur, making it probable that all are of the same kind. The interstices are filled with granular partly devitrified glass, at times changed to a greyish green substance very slightly if at all double refracting. The strips of Plagioclase are often partly or wholly imbedded in formless masses of pale yellow Augite[1]) which was evidently last to crystallise out. These Augite masses are fresh, not dichroitic, and show, though not always distinctly, a nearly rectangular cleavage. Other Pyroxenes, perhaps Diallage, are very different in appearance and almost completely changed into a dirty green, doubly refracting substance. The Olivines too are completely decomposed into a similar green substance and hydrous oxide of iron, but are still recognizable by their outlines. Black grains of Magnetite are numerous.

Von Richthofen describes the rock[2]) as substantially consisting of a monoclinic Feldspar, probably Oligoclase, and Hornblende. He finds also Mica but not Augite or Olivine. The results of his chemical analyses are as follows:

	C.	D.	E.	F.
Silica	54,58	50,30	46,52	47,54
Alumina	18,92	25,28	20,83	18,17
Ferrous oxide	10,87	12,93	9,76	10,08
Calcium oxide	7,17	5,10	10,80	8,44
Magnesia	1,15	0,94	3,21	2,84
Soda	4,08[3])	2,27	2,51[3])	3,08
Potash		1,03		0,30
Water	2,11	2,46	2,03	2,24
Phosphoric acid	1,12	trace	1,21	—
Carbonic acid	—	trace	3,13	4,04
	100,00	100,31	100,00	96,73

[1]) Haarmann (Zeitschr. d. d. g. Ges., 1873, **25**, 455) in support of the theory that the Glass basis and Augite mutually replace one another in Melaphyre, mentions the rock from Mummel as rich in granular substance but free from Augite. His observations were perhaps made on specimens somewhat decomposed.

[2]) Zeitschr. d. d. geol. Ges., 1856, **8**, 615, 619.

[3]) Determined from the difference.

„C is the freshest and most characteristic for Buchberg, in color brownish black to greenish, Basaltlike, shimmering, of uneven fracture, Apatite hardness, spec. grav. 2,741.

D the same rock but near a fissure and reddish from Rubellan [?].

E and F are from the same piece, but E greenish grey and F brown. The rock is interpenetrated by Calcite, spec. grav. of E = 2,712, of F = 2,727."

The large amount of Alumina found in these analyses is noteworthy, especially in D. The small quantity of Potash in comparison with Soda and Calcium show that the Feldspar must be chiefly if not altogether Plagioclase. The iron has been reckoned as monoxide, though it appears in the rock mostly as Magnetite, Haematite and Hydrous oxides (Fe_3O_4, Fe_2O_3, $Fe_2O_3 + nH_2O$).

Going south from Mummel along the line of hills, one finds Melaphyre exposed in various places but best in an old quarry at Nieder Zieder. The rock is in general like that of Mummel only much more weathered. Amethysts are of frequent occurrence at this quarry.

Going east from Mummel along the sharp Melaphyre ridge, weathered outcrops similar to those described are found. At Forst quarry however a rock of quite different habitus is disclosed, fresher, darker and finer grained, in fact almost aphanitic. It is not porphyric nor does it incline to form amygdaloids, is brittle and splits easily into plates. Under the microscope it is seen to consist chiefly of Plagioclase fragments of small size, not much longer than broad, and pretty constant in dimensions; tiny strips of the same mineral are rarer. Minute fissures show themselves in the Plagioclase, especially with polarized light. Augite is present, also with fissures. A variety resembling Diallage is finely striped, dirty green in color and somewhat dichroitic. Comparatively large grains of Magnetite are distributed evenly through the mass. They are often rectangular in shape, seldom apparently hexagonal. Needleshaped crystals of Apatite are numerous, Olivine was not found, nor could a glass basis be certainly recognized. The component minerals are evener in size and much more minute than those from

Mummel. It must however be mentioned that some slides labelled Forst in Prof. Liebisch's collection are exactly like those from Mummel, so that probably two varieties of Melaphyre are found near Forst. Farther east along the ridge of Forstberg rock is exposed near a small chapel where a road crosses south from Forst. As it resembles the rock from Mummel we may consider the rock at Forst quarry as an isolated point.

The Melaphyre range widens to a group of hills just before Schwarzwaldau is reached. A stone at the foot of Guckelberg, the northernmost of the group, affords specimens of a dark greenish grey rock, very fine grained and tolerably fresh. It has a slightly schistose structure and shimmering lustre on the flat side. Under the microscope it shows the same strips of Plagioclase and greenish masses probably representing decomposed Augite, that are found in the previous Melaphyres, but in addition a substance that occurs in thin hexagonal lamellae, the thinnest ones brown and somewhat transparent, thicker ones almost untransparent. Cross sections are mere dark lines but sometimes show a distinct dichroism or rather change from light to dark when revolved with only the lower Nicol. Double refraction was not observed. It must be either Haematite or Biotite, probably the latter, since thin lamellae of Haematite are generally more or less brilliant red in color. Still the fact that dichroism is never marked and often not at all to be seen in the thin crossection is against the opinion that it is Biotite. The somewhat schistose arrangement of these lamellae as well as of the Plagioclase is observed on sections made across the grain of the rock giving a not at all perfect »Fluidal structure« similar to that found in some slides from Mummel.

Further to the southeast the rock seems in general much weathered. On the road between Alt-Lässig and Vogelgesang there is a disused quarry of red, much decomposed rock free from amygdaloids. Brown red, compact, but much weathered Melaphyre is exposed at various points between Lang-Waltersdorf and Friedland both on the chaussee and

in railway cuttings. A brownred compact rock from a quarry near Lang-Waltersdorf on the road toward Friedland was analysed by von Richthofen,[1]) who calls it Porphyrite and considers it a transitional form between Melaphyre and Porphyry. The analysis gives the following:

Silica	62,74	
Alumina	12,83	
Sesquioxide of iron	5,39	
Calcium oxide	5,84	
Magnesia, Soda, Potash	11,06	(from difference)
Water	1,73	
Phosphoric acid	0,41	
	100,00	

The same writer mentions (p. 653) a good example of »Reibungsconglomerat« on the southern slope of the Melaphyre range northwest [northeast?] of Friedland. Amygdaloids containing Quartz and sometimes Barite crystals are mentioned by von Buch[2]) as occurring at Schmiedsdorf near Blitzgrund.

The handsome Storchberg between Lang-Waltersdorf and Görbersdorf presents grey cliffs of Melaphyre. A microscopic section resembles in all respects those from Reimswaldau (pag. 13), containing Hornblende, and need not be specially described. Some slides labelled Storchberg in Prof. Liebich's collection are exceedingly decomposed and no longer contain Hornblende, but sometimes hexagonal plates, perhaps Mica.

At Lang-Waltersdorf on a country road just north of the railway there is a small outcrop of Melaphyre in connection with a shaly rock showing various effects of contact, all unfortunately much decayed.

At Görbersdorf a peninsula of sedimentary rock stretches down from the north, so that the village though almost surrounded by Melaphyre mountains rests wholly on Permian. Eastward toward Freudenschloss a valley reaches up

[1]) Zeitschr. d. d. g. Ges., 1856, 8, 644.

[2]) Gesammelte Schriften, 1, 187.

between two lofty Melaphyre ranges. On the south is the Dürr Gebirge with bright red cliffs so far decomposed that specimens stain the hands red with Haematite. A quarry to the north of the valley shows quite fresh, dark grey, fine grained rock, and there is an outcrop of the same rock not quite so fresh just below Freudenschloss itself. Following the forest path eastwards and finally turning north, Zuckerberg, a mountain nearly 3000 ft. in height, is reached. On the west side of this mountain near the first houses of Reimswaldau there are quarries with the freshest rock of the region. On the other side of Zuckerberg also, where a foot path crosses the range from Reimswaldau to Dreiwasser, the rock is exposed as cliffs. Outcrops occur in Dreiwasser as well as at Gold Lehne, Freudenberg and other points on the southern side of the rectangular Melaphyre region. Rocks from all points are much alike in habitus when not too much decomposed for comparison, and the very fresh rock from Reimswaldau may be chosen as typical in microscopical appearance.

Under the microscope irregular masses of yellow brown, strongly dichroitic Hornblende, in which strips of Plagioclase and other components of the rock are imbedded, form a characteristic feature. The cleavage of about 124° is sometimes seen but regular crystal forms never. It is worthy of note that these masses resemble much in habitus the Augite masses of Mummel. In each case they must have been the last mineral to crystallise out of the original magna. An Augitic mineral, probably Diallage is present in large amount. It is of a dirty grey or greenish grey color and marked with very fine parallel stripes. It often occurs as twins and with Augite form, but sometimes as formless masses like the Hornblende. Other Augites form long strips with longitudinal cleavage and lateral fissures but without the fine striping. They are often partly turned to a green chloritic substance. All transitions from common Augite to Diallage are to be found in the same slide. Decomposed Olivines are present but a glass basis was not found, perhaps

is replaced by a green chloritic substance lying between t Plagioclases. Relatively large prisms of Apatite pierce t other minerals in the usual way. Magnetite is in lar amount, sometimes with rodlike forms.

At Dreiwasser the Melaphyre is cut off by Quartz Po phyry, but after an interruption of not more than 1 k appears again at Lomnitz as a helmet shaped portion part encircling two Porphyry hills but not rising high on the flanks. On the east end of a porphyry hill where the ro toward Friedland begins, a quarry exposes tolerably fre greenish grey rock, not so fine grained as some describ before.[1]) Under the microscope it proves to be considerab weathered. The Plagioclase, though still showing the tw lamellae, is turbid and spotted. A little brightly polarizi Augite still remains fresh but the greater part is tran formed into Uralite with dark blue green and light yell green dichroism. A small amount of Hornblende also present with yellow and brown dichroism, often lying besi masses of the Uralite as if grown together with it. Sm Olivines occur but are turned completely into a light gre dichroitic substance with black edges. Magnetite grains a scattered everywhere, sometimes rodlike in shape or rough hexagonal. Apatite and secondary Quartz are found; b glass, if ever present, seems completely decomposed. T brownish interstitial substance is always doubly refractin

Further east in the village, north of a small strea there is a second quarry much smaller than the first a containing badly weathered rock, but interesting since t Melaphyre meets shaly rocks belonging to the Permia The latter have a dip of about 45° from northeast towa southwest and underlie the Melaphyre. A curious »Reibun breccia« occupies part of the base of the quarry and pass into solid Melaphyre. It seems to consist of angular fra ments of Melaphyre cemented by a faintly reddish substan in which the texture of the neighboring shales is not

[1]) The Geological Map includes the whole hill in the Porphyr

be recognized. One might almost think the breccia had been formed by an ernption of Porphyry through the Melaphyre, but no outcrop of Porphyry is found within half a kilometer of the spot. Friction surfaces (Rutschflächen) and hardened masses of Shale are also seen in the quarry but much is covered with soil and rubbish.

North of Lomnitz towards Waldenburg there are several small points of Melaphyre scattered through the Porphyry or lying between Porphyry and Carboniferous rocks. One near Neuhaus not far from Waldenburg has long been known on account of the important quarry of road building material which opens a lofty wall of fresh rock to view and is well seen from the railway station at Dittersbach. The rock is fresh in appearance, dark green, very fine grained and not inclined to form amygdaloids. Under the microscope it does not prove as fresh as one would expect. The Plagioclase is in the form of minute strips and fragments, rarely as larger crystals. These strips are often partly imbedded in Hornblende with green and brown dichroism[1]). Small bands and wedges of a green substance between the other elements of the rock arise perhaps from the decomposition of a former glass basis; larger dark green masses from Pyroxene. Brown or orange colored oxides of iron are common.

Interesting druses of Barite, Calcite, Quartz, Fluorite are occasionally found in cavities of the Melaphyre from Neuhaus.

After an interruption of several kilometers the main range begins again at Johannisberg southwest of Lomnitz and follows the usual direction for 10 km. to Tunschendorf. The greater part is in Bohemia but not far from the Silesian boundary to which it runs parallel. Jokély thinks

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[1]) According to Rosenbusch (Mikrosc. Physiogr., 2, 397) the rock contains „neben einem oft uralitisch veränderten Augit auch primäre grün gefärbte Hornblende."

the Melaphyre in this region came in two eruptions[1]), later compacter rock occasionally breaking through an old distinctly crystalline one, and that the Melaphyre overl the Porphyry to the east, and hence is the younger of t two, representing the fourth or fifth eruptive stream in t Permian of Jicinar Kreis, Bohemia.

Three distinct varieties of rock are classed as Melaphy in this region and probably represent as many eruptio The first is met with at and near Johannisberg, a quar east of the chaussee between Braunau and Charlottenbru affording tolerably fresh specimens, dark, green grey, co pact, but porphyric from numerous crystals of Plagiocla Going southeast over the hills numerous outcrops of Mel phyre and Amygdaloids are found but very much weather Near the north end of Rosenthal the rock stands as cli and crossing a stream one finds a large quarry of ro just like that of Johannisberg but still fresher. With lens one easily sees the characteristic polysynthetic stru ture of the clear Plagioclase crystals and beside them grai or small rounded masses of smoky Quartz.[2])

Except for the presence of Quartz the rock is just li undoubted Melaphyres.[3]) Hornblende is recognizable its brown and yellowish green dichroism, more rarely fro its crystal form. It is present only in small quantiti The dirty green, faintly dichroitic masses representing fo mer Augites are in much larger amount. Very little gr nular glass is to be seen even with high powers but

[1]) Steinkohlen-Ablagerungen von Schatzlar etc. Jahrbuch d Kaiserl. Königl. Geol. Reichsanstalt, Verhandl. 1861 u. 62, 12, 1

[2]) Zobel and von Carnall (Karstens Archiv, 1831, 3, ...) d scribe the same or a similar rock from Bischoffstein, which contai though rarely, smoky Quartz and Feldspar crystals and so makes approach to Porphyry.

[3]) A Melaphyre slide is described by Boricky (Mel. Ge Böhmens, p. 51) from Johannisberg near Braunau, but no Quartz mentioned. He distinguishes two kinds of rock from this place, cl sing one with his Orthoclase Melaphyres rich in Augite, the oth with Orthoclase Melaphyres poor in Augite.

somewhat widely spread chloritic substance seems to replace it. The large porphyric crystals of Plagioclase have a dusty, impure appearance and as a rule rounded forms. The Quartz is in rounded masses, transparent as water, and almost free from inclusions, though the surrounding mass sometimes projects into it. The minute and infrequent fissures are lined with dustlike granules. A zone of radially arranged particles of much decomposed Augite and fresher Hornblende surrounds the Quartz. Olivine was not with certainty found. The chemical composition is as follows:

	I	II
Silica	59,16	58,93
Alumina	15,36	15,47
Sesquioxide of Iron	8,01	7,71
Calcium oxide	6,19	5,84
Magnesia	3,01	3,14
Potash		3,17
Soda		4,97
Loss by Glowing		2,34
		101,57

Spec. grav. = 2,7166

The rock is perhaps to be considered a transitional form between Melaphyre and Quartz Porphyry, but the relatively small amount of silica as well as the results of microscopic examination show that it stands much nearer to the Melaphyres than the Quartz Porphyries.

Crossing the hills eastward toward Ober-Schönau, a ridge with sharp points of projecting rock attracts the attention. The rock is brown black, compact and half glassy in look. In general appearance it stands about midway between the rock from Rosenthal and a rock from Goldspitz which lies further southeast. It is much weathered and with the microscope shows only strips of Plagioclase, larger than those from Goldspitz. These stand out as strips of light in a black opaque mass, perhaps once glass.[1])

[1]) A specimen collected by Beyrich at an isolated point near Johannisberg was analysed by von Richthofen (Z. d. d. G., 1856, 8, 615). He describes it as compact, almost like pitchstone, basalt

On Goldspitz (or Goldkoppe) east of Unter-Schönau where a country road crosses the hill there is an outcrop of raven-black, shimmering, half glassy rock in which a few minute Feldspar crystals are seen rendering it porphyric. It is exceedingly brittle with a tendency to conchoidal fracture. Under the microscope it is seen to consist of brown glass in which lie very tiny strips of Plagioclase and less frequently particles of Augite. Minute grains of Magnetite, often rectangular, are scattered everywhere, especially however near occasional large crystals of Augite. Here and there large crystals of Plagioclase are seen. These porphyric crystals come either alone or in groups and are often surrounded by a colorless aureole. They generally have rounded corners as if melted off. In the larger Plagioclase crystals there is sometimes a perfect network of glass inclusions partly changed to a yellow chloritic substance. Air bubbles and particles of Magnetite are also found as inclusions. The margin of the crystal is always clear and free from foreign bodies. The majority of these crystals contain no inclusions, are perfectly transparent and crossed by irregular fissures. Some have two sets of twin lamellae nearly at right angles to one another. A very few look like simple crystals or Carlsbad twins. The Augites show the usual crystal forms though generally rounded at the corners and filled with a network of fissures. Masses of Magnetite are apt to lie in or near the Augites. Other inclusions are like those in the Plagioclase. Some of the Augites seem in polarized light to be rhombic. The glass in fresh specimens is light brown

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black, of Feldspar Hardness, and Spec. Gr. 2,6275. Unweathered, with Feldspar crystals separated out. Composition:

Silica	57,82
Alumina	17,53
Monoxide of Iron .	8,43
Calcium oxide . .	10,53
Magnesia	0,65

A rock coming as a vein in Porphyry at Johannisberg is described by Boricky as very fine grained and consisting of grey brown glass.

or rather filled with very fine brown particles; in weathered ones, darker brown with larger particles. It differs in appearance from the glass included in Plagioclase. Between crossed Nicols the glass is of course opaque and the minute included crystals stand out with startling vividness.[1])

An analysis gives the following:

Silica	52,49
Alumina	15,52
Sesquioxide of Iron	10,99
Calcium oxide . .	7,26
Magnesia	4,83
Potash	3,31
Soda	3,62
Loss on Glowing .	3,36
A trace of Titanium . . .	
	101,38

Spec. Grav. = 2,7492

A weathered rock from Goldspitz contains large crystals of Plagioclase and masses of a glassy substance, probably Quartz. It is in general like the rock just described but amygdaloidal. The long ovoid amygdules contain a milky Chalcedony, Carneol, or red Heulandite.

A slide from Prof. Liebisch's collection, labelled Mittelberg near Schönau, resembles the slides described from Goldspitz, but is of rather coarser grain, contains less glass and is more weathered.

A few paces from the Goldspitz rock in the direction of Schönau there is an exposure of the ordinary Mandelstein, quite decomposed. It is somewhat lower down and is perhaps of earlier origin than the other. Whether the Goldspitz rock overlies it however was not certainly determined.

The next outcrop of fresh rock is near the village of Tunschendorf, on the steep sides of Kahlberg. Permian shows itself at various points on the south side behind the houses. On the west side on Bauer Dinter's land both

[1]) The general appearance of the rock is very like that from the Weisselstein near St. Wendel. cfr. H. Rosenbusch, Mikr. Phys. d. Mass. Gest. 1877, 383.

Permian and Melaphyre are found, the latter coming out beneath the former. The Permian consists here of red or greyish sandstones and shales lying nearly horizontally. The lower side where the strata rest on the Melaphyre is sometimes rounded and the lines curve a little upwards here and there. Just beneath is a decaying conglomerate with sandy, red or grey fragments united or rather separated by porous grey Melaphyre. The layer of conglomerate is sometimes only a few inches in thickness but varies much. Just beneath it the Melaphyre is amygdaloidal and not fresh, but a few inches lower down has the usual reddish grey compact form. At the foot of the hill, perhaps fifty feet lower down, the stream exposes horizontal Permian strata. The most natural explanation of what is here observed is that the Melaphyre in its eruption spread horizontally and forced apart the layers of Permian, an upper part resting on it, the undisturbed strata below forming its bed. No special change is noticed at the point of contact since sandstone resists metamorphic action.

Farther north and higher up on the same side of the hill there is a small quarry not far below the summit on which a monument stands. The Permian no longer shows itself above the Melaphyre but is exposed nearer the base of the hill in a sandstone quarry. Still farther around the hillside near the last house on the north of the village there is an important quarry where comparatively fresh rock is found. Alluvium covers the base of the hill except where the stream discloses Permian strata. Following an eastward branch of this stream on the north side of Kahlberg one finds everywhere on its banks Permian sandstones and conglomerates with a southwesterly dip of about 15° or 20°. Kahlberg is in fact only capped with Melaphyre and the southern part of the cap is covered with Permian.[1])

[1]) The Geological Map is incorrect at this point, since it joins Kahlberg directly with the Melaphyre on the north and does not indicate Permian on its southern side. The region needs a careful study in detail, which the present writer had no time to carry out.

The freshest Melaphyre is found in the quarry near the last house in the village. It is dark brown or grey green, fine grained and somewhat weathered. Small bright crystals of Plagioclase are to be seen with a lens. Under the microscope one finds that weathering has gone so far as to make some of the elements hard to determine. The rock is not nearly so fine grained as that of Rosenthal, contains more Hornblende, but in other respects is like it. Quartz is not found however. The Hornblende has a brown and yellow dichroism, and often seems connected with substances resulting from its decomposition, the latter having a pale green and dark green dichroism. It is perhaps Uralite. Augite is present but as a rule mostly changed to Uralite. Glass is not certainly to be found. Olivines are represented by Serpentine and carbonates with oxides of iron on the edges.

A kilometer eastward from the region just described and separated from it by Porphyry there is a narrow strip of Melaphyre reaching southeast from Vier Höfe along the Austro-prussian boundary. It rests on horizontal Permian strata. Exposures of Melaphyre and Mandelstein occur all along the hillside near Vier Höfe and Krainsdorf. The freshest rock is found in two quarries on the wooded slope not far from the road to Königswalde. It is dark grey green in color and the coarsest grained in the whole Waldenburg region. Microscopically it is not unlike the rock from Tunschendorf though fresher. The Plagioclase occurs seldom as strips, generally as masses with the various diameters nearly equal. The Augites on the other hand are much longer than broad and have many fissures parallel to the shortest diameter. They are generally faint grey in color but sometimes in part yellow or brown and dichroitic. One would almost think they pass into Hornblende. In one slide undoubted Hornblende occurs in considerable amount. The chloritic substances are of two kinds, one bluish green and often surrounded by Magnetite, the other yellowish brown or green and much like the Chlorophaeit found at

Hockenberg, which will presently be described. In some slides the yellowish green substance has the form of Olivine. Small, thin, brown colored lamellae lie between the Plagioclase crystals or in their crevices. They are not dichroitic or only slightly so, and though of irregular shape, remind one of the brown hexagonal plates (of Biotite?) in the rock from Guckelberg near Schwarzwaldau. No glass or other amorphic substance is found in fresh slides.

Several small strips of Melaphyre with their greatest length stretched northwest and southeast as usual, occur in the Permian south of Tunschendorf; and the series is closed by an important portion including the villages Dürr Kunzendorf and Kamitz. The low melaphyre hills are easily distinguished from those of the surrounding Permian formation by the darker color of the soil. The rock is mostly amygdaloids, which at Finkenhübel near Dürr Kunzendorf have become noted for the rare Zeolites enclosed in their cavities. There is a quarry at Kamitz.

The freshest rock found by the writer is from a loose stone by the roadside in Dürr Kunzendorf. It is dark greenish grey, fine grained, porphyric from scattered Plagioclase crystals. Slides made from it are most interesting under the microscope. The chief mass consists as usual of perfectly clear fragments or crystals of Plagioclase, constant in habitus but varying much in size. The largest have a zonal structure and sometimes enclose minute air bubbles or grains of Magnetite. Twin lamellae are almost always to be seen. These crystals are either imbedded in masses of Augite or a glass basis containing granules and trichites. The pale yellow or brownish masses of Augite are fresh looking, formless, brightly polarizing and like the Augite from Mummel near Landeshut. Another variety of Pyroxene not to be confounded with this, is distinguished by its prismatic form. Generally only a portion in the centre remains fresh, the rest having been changed to a yellow or green, doubly refracting, chloritic substance. Cross fissures are indicated by darker Chlorite. Some of them

as far as one can determine by revolving the slide between crossed Nicols, are rhombic (Enstatite); others closely resembling the former seem to be monoclinic however; and still others remind one of the Olivine form. Irregular masses of Magnetite are generally to be seen in or near the Chlorite and evidently come from the decomposition of the Pyroxene. On this account the seemingly rhombic mineral is perhaps better classed with Bronzite than Enstatite. Small grains of primitive Magnetite, sometimes with rectangular forms, are scattered every where. The glass wedged in between the other constituents of the rock has not seldom turned to a pale green amorphous substance. The numerous Apatite needles that pierce all the other minerals are sometimes bent or broken into several pieces. The larger ones are occasionally tubular in appearance with inclusions of a black substance here and there. One might compare their appearance with that of a thermometer tube when the column of mercury is broken by bubbles. One or two seem to have minor prisms fastened to the edges of the main one, like examples referred to by Zirkel, in certain Basalts.[1])

Hockenberg near Rothwaltersdorf lies about midway between Neurode and Glatz and forms an isolated point of Melaphyre some 7 km. east of the general line. A quarry on the highest point, at the northwest end of the hill, exposes tolerably fresh, dark green rock, fine grained and porphyric from the presence of glassy black grains. In very fresh pieces just broken from the rock these grains, which may be 4 mm. in diameter, are seagreen and transparent but soon turn black and opaque. They were described by G. Rose as Chlorophaeite and shown to be pseudomorphs after Olivine.[2]) They are very rich in iron as may be proved by examining weathered specimens from the highest points of rock, where they seem turned almost completely to oxides

[1]) Basaltgesteine, Bonn, 1870, 73.

[2]) Zeitschrift der deutschen geol. Gesellsch. 1859, **11**, 290.

of iron. The skeleton forms, so characteristic of decomposed Olivine, shine like polished metal.[1])

The upper parts of the rock seem divided into horizontal plates a few inches thick, but the usual tendency to irregular perpendicular cleavage shows itself below.

This Melaphyre has been examined microscopically by Rose and analysed by Jenzsch, who finds the following chemical composition[2]):

Silica		56,52
Alumina		13,53
Monoxide of iron		12,56
Calcium oxide		5,31
Magnesia		2,79
Potash		3,59
Soda		3,71
Phosphoric Acid		0,70
Fluorine, Chlorine, Water	Loss by Glowing	0,81
		99,52

Spec. grav. = 2,768—2,778.

Probable percentage of the various minerals:

26,93 Oligoclase } as Groundmass;
25,05 Pyroxene }
38,73 Glassy Feldspar as porphyric crystals;
5,69 Magnetite;
1,84 Chlorophaeite;
1,64 Needles of Apatite.

99,88

With the microscope he finds Glassy Feldspar (Sanidine), Apatite, Magnetite and Chlorophaeite, also a white and a green substance as Groundmass.

G. Rose[3]), who examined not only thin sections, but also plates polished on one side, mentions Magnetite, Apatite

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[1]) Tschermak describes similar examples from Bohemia. Porphyrgesteine Oesterreichs. Wien 1869.

[2]) Mikroskopische und chemisch-analytische Untersuchung des bisher für Melaphyr gehaltenen Gesteins vom Hockenberg bei Neurode, Pogg. Ann., 1855, **95**, 410.

[3]) Zeitschr. deutsch. geol. Ges. 1859, **11**, 292.

and prismatic crystals which he holds to be triclinic Feldspar, but is not quite satisfied in the matter, since the prisms seem to be rectangular. He almost inclines to think they may be Skapolith, but finally considers them Oligoclase. In reference to Jenzsch's reckoning he remarks that the Feldspar crystals are all of the same habitus and that the amount of Potash is too small to render so large an amount of Orthoclase probable. Haarmann[1]) seems to support Jenzsch in his judgment as to the relative amount of Orthoclase. The present writer follows Rose's opinion since crystals without twin lamellae are rare, and very few are divided into halves like Carlsbad twins. Probably too, some of the apparently simple crystals are not really so, but only cut parallel to the twin plane. In any case Plagioclase is present in much larger quantities than Orthoclase. The question of whether Oligoclase or Labradorite occurs, has lost much of its importance since the publication of Tschermak's Feldspar theory.

The Chlorophaeite grains are, under the microscope, yellow brown, impellucid and very slightly double refracting. Besides this, a blue green, strongly double refractive, chloritic substance occurs in most of the slides. Augite is seen everywhere as granules or fragments; larger crystals, occasionally with distinct crystal form are rarer. The Augites, which are no longer fresh, have the prism crossed by irregular fissures and are often surrounded by masses of Magnetite. In some of them the direction of obscuration between crossed Nicols seems parallel to the edges of the prism, which points to a rhombic variety. Such rhombic prisms sometimes have a parallel strip of Augite on each side. In some (fresh) slides brown, strongly dichroitic Hornblende is found sparingly, in others not at all, perhaps being unrecognizable because decomposed. The dusty impure look of the Plagioclase and the presence here and there of carbonates show that decomposition is already in an advanced stage. Fissures

[1]) ibid., 1873, **25**, 449.

inclined to one another about 120° and filled with a brightly polarizing substance often cover the Plagioclase. — Very little glass basis occurs. Apatites are common.

Loose stones are seen all along the ridge to Rothwaltersdorf, where an exposure is found east of the street behind a house. Just above it but separated by a strip of Alluvium there are Schists. The rock found here is fresh, almost black, fine grained and hardly at all porphyric. Its habitus is quite different from that of the Hockenberg rock. An Olivine observed under the microscope was changed to a serpentine like substance, Quartz and Magnetite. In other parts of the slide a yellowish substance like the Chlorophaeite of the previous rock was found. Much Augite occurs, and sometimes Enstatite with a monoclinic strip on each side. A considerable amount of glass filled with dark granules is to be seen.

On the west side of the Chalk Basin about 20 km. southwest of Landeshut there are several points of Melaphyre which, though in Bohemia, should probably be considered in connection with the Waldenburg region. The two largest are each about a square kilometer in size. One lies near Gross Krinsdorf on the road toward Schatzlar, the other at Trautenbach. A small point occurs at Schatzlar and some others southeast of Trautenbach.

Much weathered rock is found in a large quarry not far from Gross Krinsdorf. It forms two great layers separated by greenish earthy material quite decayed. Parts of the firmer rock show spots of green which in more weathered pieces turn yellowish brown. They are softer than the rest of the rock and if weathered out and the space filled with other minerals would much resemble ordinary amygdaloids. These spots come from the decomposition of Olivines, which are well seen in thin sections even with the naked eye. A fluidal structure is distinctly seen in the same way. In these slides as well as those from Trautenbach and Schatzlar little more than turbid strips of Plagioclase, Magnetite and brown oxides of iron are found.

Tschermak describes[1]) an aphanitic rock of deep ash grey color from Schatzlar and finds in it a few scattered Feldspar crystals often arranged in parallel order, and grains of milky Quartz. He compares it with the rock from Schönau, supposes a large amount of silica, and therefore places it among the Porphyrites.

The Melaphyres from these points differ completely in habitus from those of the rest of the region.

§ 4.
Melaphyre Region about Lähn.

The southwestern range in this region is remarkable for its length and narrowness. From Friedrichshöhe as far as Neundorf it is surrounded by Permian; from Neundorf to Husdorf it forms the boundary between Silurian (?) Schists on the south and Permian on the north. From Ober-Kunzendorf to a point between Neundorf and Ober Schmottseiffen it forms a succession of sharp ridges, Ziegen Rücken, Hopfenberg, Scheerberg and Langeberg, which are very characteristic and easily recognized from a distance. The rest of the narrow strip of Melaphyre does not rise to independent hills. The whole is about 16 km. long, but the rock varies but little in appearance. It is grey or brownish red in color, not so fine grained as usual, and generally covered with Mandelstein where cliffs or quarries do not disclose the compact Melaphyre in the centre.

A comparatively fresh rock from a quarry at Ober-Kunzendorf near Hagendorf may be taken as typical. The ground mass is mottled with green and grey and filled with needle like crystals having a silken lustre. With a lens one sees that they are green and have a very perfect pinacoidal cleavage and a much less perfect cleavage perpendicular to the longest axis of the crystal which may be at most 3 or 4 mm. in length. Sometimes two crystals grow through one another in the form of a Greek cross, but this

[1]) Porphyrgesteine Oesterreichs, Wien, 1869, 78.

is probably accidental, since the angle between the arms of the cross is variable. These shining needles were observed by G. Rose, who. though he seems not to have examined them except by the eye, considers them quite like Bastites from Ilfeld in the Harz described and investigated by Streng.[1]) Under the microscope the pinacoidal cleavage is very distinct. Occasional crossections show the Augite outline formed by the prism ∞P, and the two pinacoids $\infty \bar{P} \infty$ and $\infty P \infty$, but terminal planes are not found. With only the lower Nicol a strong dichroism is observed, in sections perpendicular to the vertical axis or parallel to it, green when the cleavage is parallel to the chief section of the Nicol and nearly colorless when at right angles to it. Between crossed Nicols darkness occurs in the positions just mentioned. The colors in other positions are strong. With some trouble pieces large enough for optical examination may be obtained. Plates derived by cleavage when examined in converging polarized light show chromatic rings symmetrical to the normal to the plate. All these facts make it certain that the mineral is Bastite as supposed but not proved by Rose. Grains of Limonite or other oxides of iron occur as inclusions in these crystals as well as dendritic forms of a grey substance not doubly refractive. — Common Augite also occurs in smaller quantities. It is easily distinguished from Bastite by its faint brown color,

[1]) Zeitschr. d. d. g. Ges. 1859, **11**, 289. Streng's analysis of the Ilfeld Bastite is found in the same volume p. 80, and is given below:

Silica	39,44
Alumina	8,61
Monoxide of Iron .	5,90
Oxide of Copper .	0,28
Monoxide of Man.	0,21
Calcium oxide . .	3,62
Magnesia	27,33
Potash	0,47
Soda	0,69
Water	12,45
	99,00

characteristic cleavage and monoclinic optical properties. The two minerals are not infrequently grown together in a parallel position, or the one seems to pass into the other, which apparently supports Rose's opinion that the Bastite has sprung from Augite and not from Enstatite. It is noteworthy however that Bastite is always in the middle and Augite on each side. In slides from a quarry at Ober Schmottseiffen (more weathered than those from Kunzendorf) the Bastite has generally a strip of Augite on each side. — An other Augitic mineral superficially resembling Bastite is also found in the rock. It is not dichroitic nor rhombic nor does it polarize in strong colors. The pinacoidal cleavage is not present, but at times a very fine striping lengthwise may be seen. The turbid greenish color and the absence of cleavage distinguish it from Augite. In slides from much weathered rock the Bastites are changed to carbonates and a green fibrous substance like serpentine, while masses of brown iron oxide collect on the edges. The other components of the rock from Ober Kunzendorf scarcely require a description. — The Plagioclase crystals, which make up the larger part of the rock and are no longer fresh, are tolerably large. It is doubtful if a glass basis is to be found in this rock, the weathered condition making its recognition however more difficult. If ever present it must have been only in small quantities. An analysis gives the following results:

Silica	55,12
Alumina.	14,43
Monoxide of Iron.	9,11
Calcium oxide . .	6,60
Magnesia	5,88
Potash	4,03
Soda	3,64
Volatile substances	1,85
Titanium	trace
	100,66

Spec. grav. = 2,7052

Southeastward of Ober-Kunzendorf the rock is exposed at the northwest end of Hopfenberg near Ober-Görreseiffen;

but better specimens may be obtained between this village and Neundorf, where a quarry shows the usual amygdaloids above and solid Melaphyre below. The rock weathers into concentric spherical shells. When such a spherical mass is broken, the successive layers are sharply indicated by red, concentric rings of Haematite. Why the latter is not evenly distributed is far from clear.

A quarry at Ober-Schmottseifen contains weathered reddish colored rock like that described before; but projecting rocks between this village and Klein-Röhrsdorf are rendered porphyric by Olivine pseudomorphs in oxides of iron. This is the more worthy of notice because Olivine is not found in most other parts of the range. The pseudomorphs show to the naked eye brown masses with a very distinct leafy cleavage. Under the microscope when the section is sufficiently thin the centre of the crystal is orange and transparent, but the color turns red and brown toward the edges and is on the outside black and perfectly opaque. When cut across the cleavage a change from dark to light and the reverse occur on revolving the slide with only the lower Nicol. The cleavage is so complete that often actual spaces separate the lamellae which are only kept together by the solid black crust. As the pseudomorphs seem to consist wholly of oxides of iron the Olivines must have been very rich in that metal. Very similar pseudomorphs are found in a specimen of Olivine Diabase in the Museum of Breslau University from Barhead in Scotland.

Between Klein Röhrsdorf and Husdorf the Melaphyre rises once more as a ridge. At the northwest end where a road crosses from Röhrsdorf to Carlsthal there is a small quarry of Melaphyre, quite decayed. Amethyst druses mostly falling to pieces lie about the quarry. At the other end of the ridge wher eit falls steeply toward Grundbach tolerably fresh rock may be obtained showing the Bastite crystals almost as well as the rock from Ober Kunzendorf. Near the limit of the Schists, between Ober Schmottseifen and

Ober-Görreseiffen, there are, according to Roth[1]), inclusions of Quartz and Gneiss.

A second strip of Melaphyre quite as narrow as the first begins 1½ km. northwest of Schiefer and running southwest is cut off sharply by the Bober just south of Lähn. It does not rise as an independent ridge. Like the first line of Melaphyre, to which this is parallel, it lies between the Schists and Permian, but the relations are reversed, the Permian being this time south of the Melaphyre. It is in fact a Chalk Basin with Cretaceous beds in the centre, and Permian, Melaphyre and Schists successively on each side. It seems not improbable that a layer of Melaphyre, whose edges only are now visible, has spread over the older formations and in its turn been covered with Permian and afterwards Cretaceous rocks. It must however be remarked that neighboring Melaphyre ranges lie wholly in the Permian, and, as will presently be shown, the Melaphyre from Lähn is very different in habitus from that of the Husdorf-Hagendorf range.

It is best exposed at the town quarry on the left bank of the Bober. Going south from Lähn along the river one sees first shaly and schistose strata much bent and folded. The rock feels soapy and falls to pieces when exposed to the weather. Then comes a ridge of Melaphyre, the line of juncture of the two rocks being nearly perpendicular. A little beyond is Permian and then Quadersandstein. The strata are in every case much inclined.[2])

Fresh rock from the centre of the Melaphyre quarry is dark grey green in color, other parts lighter greyish green, and weathered portions of the usual reddish brown. Above the solid Melaphyre there is a mixture of rocks,

[1]) Erläuterungen, 1867, 265.

[2]) Lüttke and Ludwig (Karsten's Archiv, 1838, **11**, 275) say that Porphyry and Mandelstein constantly accompany the Permian as far as the Bober and that their influence on the Red Sandstone near Lähn is shown in the steeply inclined strata, their disturbed »Lagerungs-Verhältnissen«, and oryctognostic constitution.

Mandelstein and a peculiar, friable, shaly rock, soapy to the touch and mottled with reddish and greenish greys. The latter rock comes in large masses, or smaller portions, moulded around the upper corners of the Melaphyre. The most probable explanation of the confused relations of the two rocks is that the Melaphyre in its eruption tore off the opposing shaly rocks and rolled them along with the already hardened blocks on the surface or front of the stream.

The Melaphyre is finegrained, not fresh, and contains large Feldspar crystals on which twin stripes may sometimes be seen with the naked eye. With the microscope these crystals prove to be fresh only on the margins, the inner parts being frequently occupied by carbonates and a yellowish green product of decomposition. The chief mass of the rock consists of minute strips of Plagioclase arranged sometimes in lines of fluctuation, grains of Magnetite, often rectangular, and perhaps a small quantity of granular glass basis. Bastite is often distinctly to be seen, but other Augitic minerals are probably represented by numerous small portions of Chlorite. Calcite is widely extended and is recognizable by its lively yellowish polarization and twin formation. Fissures filled with fibrous Calcite and sometimes an intensely green dichroitic fibrous substance occur in some specimens. Lüttke and Ludwig describe the rock at Lähn as Mandelstein with a groundmass of Hornblende and Feldspar intimately mixed[1]). According to them the amygdules are filled with fibrous Calcite, Barite and Brownspar. They consider the rock a Diorite since, although fine grained, its components may be recognized. Calcite and Barite occur in cavities of this Melaphyre.

One or two small points of Melaphyre which may be considered continuations of that just described, occur 7 km. southeast of Lähn in the narrow strip of Permian.

A parallel but much broader and more irregular range of Melaphyre lies to the north of the first. It begins near

[1]) Karsten's Archiv, 1838, **11**, 262.

Hagendorf, remains narrow till Nieder Görreseifen is reached, grows gradually wider and sending a projection to the north just beyond Nieder Schmottseifen reaches its greatest width of about $2^1/_2$ km. From this it goes in an easterly direction, but much narrower and with irregular outlines, as far as the left bank of the Bober north of Merzdorf. The range is about 12 km. long, is convex toward the south, and lies almost wholly in Permian. It consists of a series of ridges, or in some parts, of conical hills, but the ridges are not so sharp as in the first range. Pfaffenberg, the Drei Huzaren, Lindenberg, Zwickerberg, Hopfenberg near Merzdorf, Winkelberg, Speerberg and Frauenberg are the chief summits, the latter three or four being conical. The first exposure of rock on the northwest is in a small quarry near the Seifenhäuser just across a stream from Pfaffenberg. It is weathered, fine grained and like that of the first range. On Pfaffenberg the exposures are still more weathered. Rock is seen on the street in Nieder-Görreseifen but not fresh, also on the southwest side of the Drei Huzaren where a country road ascends. Large amygdaloids with Quartz druses occur here. On the east side of the valley near the church in Nieder-Schmottseifen there is a quarry, and a kilometer east of the village a row of hills along the stream shows various points of rock, especially Hopfenberg, the one to the south, where Bastite crystals are numerous and just like those from Ober Kunzendorf. The Melaphyre widens here to a plateau on which are conical peaks but the rock is very little exposed. On Frauenberg just east of the chaussee between Lähn and Löwenberg there is a small exposure of Melaphyre and Mandelstein. J. Roth mentions inclusions of coarse grained Calcspar on Speerberg north of Merzdorf[1]).

The rocks of the whole range are grey or brownish and very much weathered. The freshest is probably that from a road on the south side of Hopfenberg between Schmottseifen

[1]) Erläuterungen. p. 265.

and Merzdorf. Bastite crystals are characteristic of many parts and show the usual very perfect cleavage parallel to the vertical axis with a less perfect one at right angles to it, but they are generally almost colorless and not dichroitic. Cross sections often have the Augite outline well brought out by an edge of brown. Common Augite and a variety like Diallage are also sometimes recognizable but in smaller amount than the Bastite. Olivines are not rare but always as pseudomorphs in oxides of iron and serpentinelike substances. The tolerably large Plagioclase crystals are much decomposed and often changed to Kaolin. Fissures in the crystals are sometimes lined with purplish dots, perhaps Haematite arising from the decomposition of neighboring minerals. The interstices are filled with a dirty brown granular substance, not glass, which is one of the first substances to be attacked by decomposition. An almost isotropic green substance filling the same place is rare. The Chloritic substances in slides from Hockenberg often show a dark cross in polarized light from the radial arrangement of the fibres. Veins of a beautiful emerald green Chrysotile are found in a slide from Zwickerberg. Calcspar occurs in large amounts in most of the slides.

On the east side of the Bober, Melaphyre is first met at Dippelsdorf. It forms a series of hills at first narrow but rapidly widening till at Wiesenthal it is 2 km. broad. It then once more narrows to a single ridge and ends a kilometer from Schönwaldau. The surface forms in general a plateau from which rounded summits rise, but Menzelberg between Wiesenthal and Schönwaldau stretches as a long ridge toward the southeast in the way so often seen in Silesian Melaphyres.

An opening in a low bank south of the road in Dippelsdorf shows large rounded masses of Melaphyre and Mandelstein[1]) united by a greenish or reddish clayey material. The upper part is formed by the latter almost exclusively. Some

[1]) Dippelsdorf lies in the Permian on the Geol. Map.

of the blocks here exposed are as much as two feet thick, but all much decayed. The bank seems to have been heaped there by the force of water, perhaps of the Bober before its present bed was formed.

There is a small quarry by the road on Mimrichsberg southeast of Dippelsdorf, in which reddish or purplish Melaphyre and Mandelstein are found. Bastite may be recognized in slides made from it, and it resembles in habitus the last range.

Rock is also exposed in various places along the north side of the hills as one goes toward Süssenbach and between this village and Wiesenthal on the chaussee, but always very much decayed. On the south side of Pfaffenberg near Wiesenthal by the same chaussee there is a quarry of rock resembling that from Lähn. Large porphyric crystals of Feldspar are seen in it. Under the microscope the Plagioclase is seen to be turbid and no longer fresh. A very few of the larger crystals are nothing but a network of Serpentine fibres with the spaces filled out with carbonates. It is hard to say what they were originally, probably not Plagioclase. No Bastite could be recognized, but small pseudomorphs after Olivine seem to be present.

On the southern slope of Menzelberg where a footpath crosses toward the Würfel-Häuser, a very fine grained, fresh-looking greenish grey rock is met. It is very hard and less weathered than any other rock in this range. In habitus it differs completely from the rest. Small crystals of Feldspar may be seen with a lens. Under the microscope one sees chiefly very minute strips of Plagioclase and fragments of Augite. A granular glass occasionally appears in the phorphyric Plagioclase crystals but seems replaced in the groundmass by a nearly isotropic green substance. The Plagioclase has often a zonal structure and twin lamellae in two directions. Large masses of Serpentine result probably from the decomposition of Olivines.

In this range there are three different varieties of Melaphyre; at Mimrichsberg near Dippelsdorf like the Melaphyre

of the western range, at Pfaffenberg near Wiesenthal like that from Lähn, and at Menzelberg different from any yet described in the Lähn region.

A rounded portion of Melaphyre southeast of Süssenbach is separated from that of Menzelberg by a strip of Alluvium less than half a kilometer wide, and may be taken as belonging to the portion last described. No fresh rock seems to occur.

The next tract extends about $2^1/_2$ km. on each side of Ober-Falkenhain and is about 2 km. broad. Only $^1/_3$ of a kilometer separates this portion from the last. Here as in other parts the hills stretch as ridges from northwest to southeast. This is especially noticeable in Rauenberg to the west and Buchberg to the east.

The rock to be seen on Rauenberg, which lies east of the chaussee midway between Probsthain and Schönwaldau, is remarkable for its large amygdules of Chalcedony, Quartz, Carneol etc., but is very much weathered. Similar rock but with smaller amygdules is found on the hills toward Ober-Falkenhain and in one or two small quarries on the hill sides by the village. Following a road which starting from a Gasthaus leads along the south side of Buchberg, a small quarry with somewhat fresher rock is seen. It is like the usual rock of the region, not very fine grained and containing Augite and some Bastite. Red sandstone lies not far away on the hillside, quite horizontal and apparently undisturbed by the Melaphyre.

The freshest rock in this portion is found however in the public quarry (Gemeindebruch) at the southwest end of Ober-Falkenhain just beyond the signpost on the road turning south.[1]) It is very fine grained, grey green and without amygdaloids. The minute strips of Plagioclase which make up the mass of the rock are of the usual kind. A small amount of granular glass fills the spaces between them. Crystals of Bastite with longitudinal stripes, a lively

[1]) This Melaphyre seems to lie beyond the limit of the rock as indicated on the Geological Map.

polarization and green and yellow dichroism are present in considerable amount. Strips of Augite also occur, sometimes lying on each side of a Bastite. There are also many very small fragments of a yellow and brown dichroitic mineral (probably Hornblende) sometimes in connection with a green substance likewise dichroitic. Comparatively large Olivines are turned to carbonates which enclose portions of Serpentine.

A specimen taken from a large boulder lying at the southeast end of Buchberg and probably having its origin not far away, proved very interesting and differs considerably from the last described. The rock is fresh, green black and very fine grained. Plagioclase occurs as strips longer than broad with thoothed or irregular ends. Granular glass, Magnetite grains, often rectangular, and Augite fill the spaces, the latter having the form of long strips of a faint brownish color. Strips of Bastite are comparatively infrequent and are generally accompanied by a strip of Augite on each side. The two are perfectly easy to distinguish. The Bastite is green, dichroitic, and in polarized light becomes dark when the prismatic edges are parallel to the chief section of the Nicol; while the Augite at the sides shines out brilliantly in that position, is faint brown in color, nondichroitic and shows the characteristic cleavage Cross sections of this combination show the Bastite in rectangular form bounded by the two pinacoids, and on each side Augite limited by the prism planes and the clinopinacoid. The Augite strips on each side may stand in the relation of twins to one another, and Augite twins occur alone. A good deal of granular glass lies between the Plagioclases and glass inclusions occur in the larger crystals. The rock in general resembles that from the quarry at Ober-Falkenhain but is fresher and contains none of the brown dichroitic substance of that rock. Slides from this specimen are perhaps the most interesting in the whole region around Lähn.

Hopfenberg near Hohenliebenthal stands a little more than a kilometer southeast of Buchberg. It is a sharp ridge parallel to the former ones and wholly surrounded by allu-

vium. It is only about half a kilometer long, but yet of considerable interest. On the southeast end there is a large quarry of fresh, very fine grained, green black rock much like the last. Here also Bastite and Augite occur grown together but not so often nor in so fine examples. The Bastite is occasionally quite enclosed in Augite, which was not observed in the former rock. Olivines turned to Serpentine and edged with brown are common. Other Serpentine or Chlorite like substances seem almost isotropic or are radially fibrous and show a dark cross in polarized light. Hornblende is not found.

The most interesting feature however is the inclusion of large masses of sedimentary rock in the Melaphyre at the east end of the quarry. This rock is light grey green in color, partly shaly and partly calcareous and is evenly stratified in layers an inch or more in thickness. Portions several feet across are enclosed in the decayed amygdaloidal rock in the upper part of the quarry, and the thin strata are curved and moulded about the Melaphyre masses. Lower down where the limestone comes in contact with solid Melaphyre, the latter sends veins and offsets into it and the two are perfectly cemented together so as to break like a homogeneous rock. The limestone, or perhaps better marl, has at these points become very hard and for a few mm. away from the Melaphyre forms a series of lighter and darker wavy bands. Sometimes a small ovoidal portion is almost completely enclosed by the Melaphyre and looks very much like an amygdule.

It is evident that the Melaphyre in its eruption carried up masses of the rock through which it burst. Some parts were simply rolled and twisted, perhaps while still moist and plastic, among the slag and larger masses already cooled and covering the surface of the still melted rock. The parts that came in contact with the fluid Melaphyre were partly penetrated by it and to some extent metamorphosed.

A small quarry of very coarse grained Melaphyre is reported to occur southeast of Hopfenberg at a point near

Johannisthal on the chaussee between Hirschberg and Schönau. It is comparatively coarse grained, much weathered, and in general quite like the rock from Ober-Kunzendorf though larger in the grain. Bastite is common and has the green color, cleavage, dichroism etc. characteristic of that mineral. The spaces between the Plagioclase crystals are filled with a dirty brownish or greyish, slightly doubly refractive substance which is full of black dust and granules, probably of Magnetite.

North of Schönau there are three small portions of Melaphyre grouped around Willenberg so celebrated for its columnar Porphyry. One is at Nieder-Roversdorf on the chaussee leading to Falkenhain, another between the Porphyry and Schists on the east bank of the Katzbach, and the third and largest wedged in between Porphyry and Permian. According to J. Roth the Melaphyre is younger than the Porphyry which overlies it and has pushed itself out from under that rock.[1]) An outbreak of Basalt comes in contact with it near Rosenau. The Melaphyre is exposed by the blastings for the chaussee north of Rosenau but is reddish and not at all fresh. Only Plagioclase and Olivine are to be recognized with certainty. A dirty brownish granular substance perhaps arising from the decomposition of glass is common, and chloritic substances and carbonates are present in large amount.

§ 5.
General Conclusions.

Superficially considered, the eruptive rocks represented as Melaphyre on the Geological Map of Lower Silesia have much in common. They are all fine grained, dark colored rocks inclined to take on the amygdaloid form. They show almost everywhere a striking parallelism in the direction of their ranges and in their relations to the neighboring sedimentary rocks; stretching as a rule from northwest to

[1]) Erläuterungen, 263.

southeast and occurring at the edge of the Permian if not surrounded by it. Still if examined more closely, several important differences show themselves between the rocks from different places. The grain may become finer or the rock take on a half glassy texture, various minerals may be separated out in a porphyric way, and the whole habitus of the rock from one place may differ much from that of another. These differences, which are apparent from out-door study with the naked eye or a lens, become still more evident with the microscope, so that one no longer hesitates to divide the rocks into several varieties, if indeed they should all remain included under the general name Melaphyre.

A classification must depend on their mineral constitution, which has been described in the foregoing pages; but a brief general description of the more important minerals and their mode of occurrance is necessary here to determine their value in classification.

In the microscopic sections examined by the writer one finds Plagioclase and one or more varieties of Pyroxene, which occur in all slides made from unweathered rock. Hornblende occurs in many, Biotite in a few, Olivine in most of them. Quartz is found only in one part. Magnetite and Apatite show themselves everywhere but in relatively small amount.

Among secondary minerals, i. e. those resulting from the decomposition of original minerals, must be mentioned the chloritic substances, various oxides of iron, Calcite and other carbonates and Quartz or Chalcedony.

Of the primary minerals, Plagioclase is by far the most important in amount, and generally forms more than half the bulk of the rock. It is however impossible to say in every particular instance just what member of the series occurs. Setting aside unreliable reckonings from the amounts of Sodium, Potassium, Calcium and Silica found by analysis, the only way of distinguishing them is by their optical properties. This method can give exact results only when

the Plagioclase section is parallel to P=oP or M=∞P∞, something not easily determined in a microscopic section. Whatever the variety of Plagioclase, it generally occurs in simple tabular or prismatic forms or fragments of such, which in their sections form strips, generally much longer than broad. The most minute have parallel edges and the ends forked or fringed or cut square off. The larger ones are either irregularly shaped pieces wedged together or have more complete crystal forms but never very complicated ones. They often show a zonal structure indicating stages in growth; and they are in the great majority of cases polysynthetic.

It is very doubtful if Orthoclase is common in Silesian Melaphyres, though Jenzsch, Tschermak, Boricky and others are of that opinion. Crystals differing in habitus are seldom found together. It is true that crystals with twin halves are sometimes seen which might be considered Carlsbad twins, and also apparently simple crystals; but when, as in a microscopic slide, so many crystals are cut in every conceivable direction, it would be strange indeed if none were cut parallel to the twin plane. It is also a question if Plagioclase never occurs as simple crystals. The small amount of Potassium found in most of the analyses is by no means decisive in favor of Orthoclase, since, according to Rammelsberg,[1]) as much as three, four and even more percent Potash is not seldom found in Oligoclase, Andesine and Labradorite. However on the other hand it cannot be affirmed that Orthoclase is not present in small amounts in these rocks; but the amount must be too small to be of importance in a system of classification.

Pyroxene is found in every section of tolerably fresh rock, but varying much in amount and habitus. Sometimes it occurs as faint brownish or yellowish masses or grains of irregular shape and containing Plagioclase and other elements of the rock imbedded in it. This variety, which is

[1]) Handbuch der Mineralchemie. 2. Aufl. Leipzig, 1875, 560.

generally fresh looking, polarizes with bright colors, and shows the peculiar rough surfaces characteristic of Augite in thin sections, was evidently the last mineral to crystallize out. This form is well seen in slides from Buchberg.

All transitions may be seen between the last form and a variety resembling Diallage, with mostly elongated shapes. A striping with fine parallel lines often becomes visible and the Augite passes into Diallage. The latter is generally dirty greyish or greenish in color and does not polarize in bright colors. It may be studied in slides from Reimswaldau.

Beside these monoclinic Pyroxenes there is not infrequently a rhombic member of the series, probably Enstatite or Bronzite at first but generally changed to Bastite. It usually takes the shape of prisms with very distinct pinacoidal cleavage and a less complete cleavage perpendicular to it. The crystals are relatively large, without definite end planes, are dichroitic, and polarize in bright colors. The Pyroxenes are the most important element in classifying the rocks under discussion.

Brown, strongly dichroitic Hornblende is largely represented in the Waldenburg region. It generally appears as irregular particles or masses, often containing other minerals imbedded in it. Distinct crystalline forms are rare. It is perhaps best seen in rock from Reimswaldau.

A brown, slightly transparent mineral occurs as hexagonal plates in slides from Guckelberg in considerable amount. It is probably Biotite, but the rock is no longer fresh enough to make the determination very sure. The cross sections, which are narrow strips without any appearance of cleavage, are very little if at all dichroitic.

Olivine occurs as porphyric grains or crystals in the majority of the rocks here treated of, but is so variable in distribution that it can hardly be employed in classification. For example, it occurs in large amount in the rock from a point between Ober-Schmottseifen and Klein-Röhrsdorf, while at other points, e. g. Hagendorf, it is not to be found, though the rock is very uniform in other respects. To se-

parate rocks so much alike in every way and forming parts of a range so evidently of one origin, does not seem to correspond with the facts of nature.

Near Schönau in Bohemia a brown glass full of dust-like granules forms the chief mass of the rock; in other parts glass only appears wedged in between the other constituents, often in very small quantities. In a few specimens no glass at all can be recognized.

With the addition of Quartz which comes as porphyric grains in the rock from Rosenthal, the foregoing are the only minerals that need be taken into account in classification.

Before going further it is necessary to have a definition of Melaphyre; if indeed we do not follow the views of Haarmann and others and do away with the term altogether, dividing up the rocks formerly included under it among other groups. Since most if not all of the Silesian rocks classed as Melaphyres have a tolerably constant habitus, quite as constant as the Basalts, for example, and are of the same age, coming always in connection with the Permian, it seems advisable to retain the name; especially since there are difficulties in the way of distributing them among other groups.

Rosenbusch sees in Melaphyre[1]) a porphyric development of the Olivine Diabases and defines it as an older massive rock consisting essentially of Plagioclase, Augite and Olivine with free oxides of iron and a basis of some kind in varying amount. The rock is usually of the age of the Coal Measures or Permian, seldomer of the Triassic.

This definition includes most of the rocks here in question, but not quite all, since Olivine and a basis (or amorphous ground mass) are not always to be found with certainty. Following Rosenbusch's definitions, if Olivine is absent but the other elements, including a basis of some kind are present, the rock, is Diabase Porphyrite; if a basis is absent as well as Olivine, it is Diabase Proper.

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[1]) Mikroscop. Physiographie der massigen Gesteine, 1877, 392.

An attempt at a classification according to this system follows: —

1. Melaphyre occurs at;

Mummel, Forst (in part), Reimswaldau, Tunschendorf, Hockenberg, — Field between Röhrsdorf and Ober-Schmottseifen, Lähn, Hopfenberg near Wiesenthal, Menzelberg, Falkenhain, Buchberg near Ober-Falkenhain (some others, such as Dürr-Kunzendorf, are doubtful).

2. Diabase Porphyrite;

Goldspitz and Mittelberg near Schönau, Rothwaltersdorf.

3. Diabase Proper;

Probably Forst quarry, and most of the long range southwest of Lähn including Ober-Kunzendorf.

These groups might be subdivided into varieties containing considerable amounts of Hornblende, Enstatite or Bastite etc.; but it is difficult to decide if glass is present, in every case, and Olivine is very variable in its occurrence. It is only found at one point, for example, in the middle of the Husdorf-Hagendorf range southwest of Lähn, though the rocks of that range are in all other respects very uniform. For the reason just given the system seems not specially applicable to Lower Silesian Melaphyres.

The system adopted by Boricky for the neighboring Bohemian Melaphyres also seems unsuited for those of Silesia. His main division is into Orthoclase and Plagioclase Melaphyres, with subdivisions into those rich and poor in Augite. There are no subdivisions for rocks rich in Bastite or Hornblende. As the present writer finds very little if any undoubted Orthoclase in the Silesian rocks, the main division does not apply. In regard to Augite it seems better to indicate what replaces it in rocks poor in that mineral.

Two well marked types of Melaphyre occur in Lower Silesia without transition forms; those where half or more than half of the mass consists of glass, and those in which glass fills a subordinate place wedged in between the other elements of the rock. The second of the two is very ex-

tensive and may be divided into Augite Melaphyre, Hornblende Melaphyre and Bastite (or Enstatite) Melaphyre.

The classification of the Lower Silesian Melaphyres stands then as follows: —

I. Glassy Melaphyre (half or more than half glass),
II. Crystalline Melaphyres (but little glass);
  a. Augite Melaphyre,
  b. Hornblende Melaphyre,
  c. Bastite (or Enstatite) Melaphyre.

Transitions occur between the subdivisions of the second group, which includes all the rocks here treated of except near Schönau in Bohemia where small portions are occupied by the first. As more or less glass is found almost undoubtedly in all fresh specimens it may be concluded that probably all have contained it at one time.

The classification here given represents tolerably exactly the relations of the rocks as they occur in the Melaphyre ranges described in previous pages, as a brief sketch of them will show.

In the Waldenburg region Augite Melaphyre occurs at Landeshut and on past Forst. Storchberg, Buchberg and other points around Görbersdorf show Hornblende Melaphyre, and the same though not so rich in Hornblende occurs at Neuhaus and Lomnitz. Hornblende is found again at Rosenthal[1]) but then an interruption occurs and we find an isolated portion of Glassy Melaphyre at Mittelberg and Goldspitz near Schönau. After this interruption, Hornblende Melaphyre is found at Tunschendorf and again in the eastern range at Vier Höfe. The rock from Hockenberg stands about midway between this and Augite Melaphyre and farther south at Dürr Kunzendorf no more Hornblende is found.

[1]) The rock from Rosenthal, though in its Groundmass like other Hornblende Melaphyres of the region, is marked off very decidedly from the rest by the presence of free Quartz, which occurs along with Plagioclase as porphyric grains, and gives the rock the look of a transitional form between Melaphyre and Quartz Porphyry. The analysis (p. 17) and the microscopical appearance (p. 16) place it however much nearer to the Melaphyres than the Quartz Porphyries.

Coming now to the Lähn region we find Bastite Melaphyre in the long range to the southwest, also in the broad range to the North. Bastite is not so abundant in the strip at Lähn. On the east side of the Bober we find much Bastite at Mimrichsberg, very little at Pfaffenberg near Wiesenthal and none at Menzelberg where Melaphyre proper occurs. At all points east of this a considerable amount of Bastite shows itself. At only one point, the Gemeindebruch, Ober-Falkenhain, is Hornblende found and then in small amounts and in connection with Bastite.

In general Hornblende characterizes the rocks of the Waldenburg region and Bastite those of the Lähn region.

In regard to its geotectonic relations, the Melaphyre of Lower Silesia occurs in two chief forms, as long sharp ridges and as outspread layers with irregularly placed rounded or conical hills. The ridges often have steep slopes on each side, while the conical hills have usually gentle slopes. In some cases, if not all, the sharp ridges may be considered simply the edges of widely spread layers which have been covered by sedimentary rocks, more or less bent or tilted, and then brought prominently forward by the washing away of the softer rocks on each side. The fact that the Melaphyre ridges run parallel to the strike, as well as to the ridges, of the neighboring sedimentary rocks is in favor of this view. In some places there are evidences of two eruptions spreading in this way, the later over the earlier, as at Landeshut and near Gross-Krinsdorf. The surface of the Melaphyre is in the majority of instances covered by amygdaloids which form simply the vesicular upper layer. It is perhaps not rash to conclude that where this layer exists we have the upper surface of a Melaphyre stream, though to affirm that where amygdaloids are not found, the surface has been denuded, might not in every case be correct. If this rule be applied in the region near Lähn it would show that the remarkably long sharp ridges of the southwestern range are not the outcropping edge of an outspread layer, since where cliffs or quarries expose a

section of rock the Mandelstein appears caplike over the solid Melaphyre, not sloping down one side and leaving the other bare, as would be the case on the other supposition. This, if admitted as evidence, would show that the Melaphyre in that range had risen through a long fissure and cooled without spreading. Its relations to the neighboring strata would show whether this is correct or not, but they are generally covered with soil and the writer had no opportunity to examine them. The parallel strip of Melaphyre at Lähn seems undoubtedly the edge of a layer exposed by the tilting of the whole series of rocks.

In the Waldenburg region the Melaphyre is outside of the Porphyry on the edge of the Chalk Basin, except near Schönau where it is inside. It seems probable that the outer Melaphyre is older and the inner younger than the Porphyry. At Nieder-Zieder the Melaphyre is pierced by veins, apparently of Porphyry, though the rock is too much decomposed to make it certain. At Lomnitz and near Vier Höfe Melaphyre comes below and Porphyry higher up on the hill sides; both facts going to show that the Melaphyre is the older of the two. This is also the opinion of Beyrich[1]) as mentioned in the historical sketch. Jokély[2]) considers that the Melaphyre between Johannisberg and Rudelsdorf overlies the Porphyry and hence is younger than it. In both portions the Melaphyre is Permian in age.

In the Lähn region the Melaphyre in several places rests on schists and has the Permian as overlying rock, as, for example, at Lähn, but Beyrich considers it as belonging exclusively to the Permian and not older than it. It comes in contact with Porphyry only at one place near Schönau and is there proved to be the younger rock of the two by its inclusions of Porphyry.[3])

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[1]) Zeitschr. d. d. geol. Ges., 1850, **2**, 266—267.

[2]) Jahrb. der kais. königl. Reichsanstalt, 1861—62, **12**, 172.

[3]) Roth's Erläuterungen, 1867, p. 263.

The Minerals
of
The Lower Silesian Melaphyres.

These occur in Amygdules, Cavities, Veins and Fissures, Amygdules being the commonest, and occurring almost everywhere in connection with Melaphyre. Amygdules have generally an outer layer of dull dark green Delessite; if small the whole space may be filled with it. Next come Calcite and Quartz. If Calcite, the space is generally completely filled; if Quartz, there is usually a layer of Chalcedony or Agate followed by drusy Quartz leaving a vacancy in the centre. Calcite crystals, Zeolites etc., may rest on the Quartz.

Quartz.

Silica in its various forms is perhaps the commonest Mineral of all in the Melaphyres. It appears as Common Quartz, Amethyst, Chalcedony, Agate, Carneol etc.

Chalcedonies ranging in color from the deep red of Carneol to honey yellow or grey or white, as well as Agates, have been found at Buchberg near Landeshut, Goldspitz and other points near Schönau. The Agates from Finkenhübel near Glatz are specially well known. In the latter place they are sometimes filled with radiating fibres of Göthite (Nadeleisenerz). A reddish opaque Chalcedony has been found there as a pseudomorph after Calcite. Chalcedony and Carneol occur also at Rauenberg between Süssenbach and Falkenhain in the Lähn Region. Very large masses are found there.

Amethyst with varying fineness of color is found at many points, those from Nieder-Zieder south of Landeshut being well known. „Hair Amethysts" containing fanshaped bundles of Göthite are found at Mummel and Forst near Landeshut and at Finkenhübel. Smoky Quartz is occasionally found in Geodes, as at Tunschendorf.

Common Quartz fills amygdules everywhere; e. g. in the Waldenburg region, Buchberg, Forst, Lomnitz, Neuhaus, Tunschendorf, Finkenhübel, near Schatzlar; and in the Lähn region at Rauenberg, Falkenhain and Hopfenberg near Hohenliebenthal.

As a rule only the rhombohedral and prismatic planes are to be seen, though other forms are not rare. The rhombohedral planes in Quartz druses from Mummel and Forst are often covered with wavy concentric lines like ripplemarks. Dihexaheda of Smoky Quartz with very narrow prism planes are found in cavities near Neuhaus.

The rare plane $\xi = \frac{P_2}{4} = \frac{1}{4}(2a:a:2a:c)$, of a trigonal pyramid blunting the alternate edges of the usual hexagonal pyramid is found in Quartz from Falkenhain. This plane was observed by Websky also in crystals from the Maudelstein of Finkenhübel.[1]) He describes also a very remarkable case of Quartz twins from Neuhaus near Waldenburg,[2]) occurring in an Amethyst druse. One crystal stands upon the other in such a way that R of the one is directly above R′ of the other, and r above r′. Contrary to the usual rule, r is larger than R. The prism plane g is very narrow. On every alternate corner in each crystal there is between r and r a series of three planes s, ε and μ forming a zone with R and g. Immediately below these planes is the same series reversed, g, μ, ε, s and R. The planes are as follows:

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[1]) Ueber einige bemerkenswerthe Vorkommen des Quarzes, Neues Jahrbuch für Min. 1874, 115.

[2]) Ibid., 113.

$$R = \rho_d\ (0111) = R,$$
$$r = \rho_l\ (0111) = -R,$$
$$g = \rho\ (0110) = \infty P,$$
$$s = \rho_r\ (1211) = \frac{2P2}{4},$$
$$\varepsilon = \rho_{II}\ (1321) = \frac{3P\frac{3}{2}}{4} = \frac{R3}{2},$$
$$\mu = \rho_{II}\ (1431) = \frac{4P\frac{4}{3}}{4} = \frac{2R2}{2}.$$

At Finkenhübel right and left twins are found.

A specimen found by the writer in Forst quarry is interesting from the growth of Quartz on Calcite crystals in such a way that R of the Quartz is parallel to $-\frac{1}{2}R$ of the Calcite and the median line of each is in the same direction. The Quartz crystals are flattened into scale like forms and sometimes occur alone but generally a number together and in one case make a complete cover over the top of the Calcite. In the latter case the surface of the thin casing of Quartz was even enough to permit of measurement by the Reflecting Goniometer. The angles found came within about half a degree of the angle for $-\frac{1}{2}R$ in Calcite (134° 57′). The Quartz sometimes lies a little below the surface, the Calcite having grown up around it. A careful examination shows that a few of the crystals are irregularly placed in reference to the Calcite rhombohedral planes, but all are flattened parallel to them.

Instances of the regular growing together of Quartz and Calcspar are so rare that perhaps a brief summary of those already described may be of interest.

Instances of the kind from Schneeberg in Saxony, were mentioned and figured by Breithaupt[1]) in 1836 and at various times since.

Eck described specimens from Reichenstein in Silesia (formerly considered Quartz twins by G. Rose, the Calcite crystal being out of sight beneath.)[2])

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[1]) Handbuch der Min., 1836, **1**, 309; also 1847, **3**, 673; — Paragenesis, 1849, 228, Atlas, Fig. 344; — Jahrb. Min., 1861, 575; — Berg- und Hüttenm. Zeitschr. 1861, 157.

[2]) Zeitschr. d. g. Gesellsch., 1866, **18**, 426.

Aug. Frenzel and G. vom Rath[1]) describe very fine examples from Schneeberg in Saxony and give interesting figures in illustration.[2])

Edward S. Dana of New Haven, U. S., gives descriptions and a figure of specimens from the Yellowstone National Park.[3]) His figure represents a Calcite crystal completely enclosed by three Quartz individuals, and is quite similar to figures given by vom Rath,[4]) but somewhat more complicated.

Specimens have been found at Reichenstein, Silesia, in considerable mumbers by R. Hare.[5])

Calcite.

This is by far the commonest mineral next to Quartz in the Silesian amygdaloids. It generally fills the whole amygdule. Well formed crystals are seldom found in amygdules but must be sought for in cavities or fissures. As a rule they rest on Quartz or Amethyst druses and of course are of later deposition than the Quartz.

Interesting specimens may be found at Mummel near Landeshut. Some are much weathered, ash grey in color and of rough stalactitic form. Though sometimes several inches long the cleavage shows them to be single crystals. Others have better developed forms in which $-\frac{R}{2}$ and the prism ∞R or a very sharp rhombohedron are predominant. Inclusions of Haematite or Göthite occur.

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[1]) G. vom Rath: Mineralogische Beiträge, — Ueber eine regelmässige Verwachsung von Quarz und Kalkspath, Verhandl. naturhist. Ver. der preuss. Rheinl. u. Westf., Bonn, **34**, 5. Folge, Bd. IV, p. 56 of the Sep.-Abdr. August Frenzel und G. vom Rath: Ueber merkwürdige Verwachsungen von Quarzkrystallen auf Kalkspath von Schneeberg in Sachsen. Monatsbericht, Berlin. Akad. 5. Nov. 1874; — Pogg. Ann., 1874, **155**, 17.

[2]) A very lively correspondence in regard to priority arose after the publication of their observations, Weisbach appearing as defender of Breithaupt's claims to priority (Jahrb. Min. 1875, 627; and 1876, 171), and eliciting replies from G. vom Rath (Jahrb. Min. 1875, 857; 1876, 398), and from H. Eck (Jahrb. Min., 1876, 405).

[3]) Zeitschr. für Kryst. u. Min.

[4]) Handb. Min., 1876, Fig. 13 and 13a, Plate VIII.

[5]) Zeitschr. für Kryst. u. Min., 1880, **4**, 298—99.

Other crystals are double, an outer one enclosing an inner one with a completely different set of planes. The cleavage passes through both, so that they are symmetrically placed in reference to one another. The inner crystal is darker in color and shows through the semitransparent outer one. The outer crystal shows $-\frac{1}{2}R$ well developed but striped parallel to the edges of the chief rhombohedron. A number of sharper rhombohedra of the same order as $-\frac{1}{2}R$ form a curve from this plane to the sides, which are formed by a very sharp rhombohedron of the first order. The upper edges of $-\frac{1}{2}R$ are blunted by $\frac{R}{4}$ with very narrow planes. Three dark lines radiating from the central point on top the crystal parallel to the striping on $-\frac{1}{2}R$ indicate the upper edges of the core which are formed by a comparatively sharp rhombohedron of the first order. In some of the crystals a somewhat sharp scalenohedron is found, and the inner crystal is not always completely covered but projects in a sharp point above. Except $-\frac{1}{2}R$, the faces are too rough and incomplete for measurement.

A similar structure is found in crystals from Vogelberg between Alt-Lässig and Conradswaldau. A crystal ending above in two scalenohedra of the same order, one sharp, the other very blunt, is enclosed in a symmetrically placed shell which has the planes of the prism and $-\frac{1}{2}R$ in preponderance, and a very sharp scalenohedron subordinate. The outer crystal is sometimes broken away, thus displaying the inner one very distinctly. The crystals are, like the previous ones, large, often nearly an inch in diameter, but have dull or rough surfaces.

Baryte.

This mineral occurs in the Waldenburg region at several points; Fuchswinkel and Schmiedsdorf near Friedland[1]), Bärengrund near Waldenburg, Stubenberg near Schönau, and Trautenbach not far from Schatzlar in Bohemia. In the

[1]) L. von Buch, Beobachtungen auf Reisen, 1802, 60.

Lähn region it is found resting on Calcite in Geodes from the left bank of the Bober near Lähn. It is fleshcolored and opaque. The tabular forms in which it appears are made up of innumerable minute crystals. Good specimens in the University collection in Breslau were obtained from Leissner in 1881, and come from a druse cavity opposite the Schlossberg near Neuhaus. The crystals rest on Quartz and are accompanied by Calcite, Fluorite and Iron Mica (Eisenglimmer). When not colored by Haematite (Eisenglimmer) in small particles, they are colorless and transparent in the centre, greyish white and untransparent at the edges. The outer part often looks as if formed of a succession of layers. The tabular crystals, though united at the base where they rest on Quartz, are often as much as 15—18 mm. broad and 20 long. The observed faces are:

p = $\infty\breve{P}\infty$, best developed and smooth in the centre;
l = $\infty\breve{P}_4$, uneven and somewhat striped parallel to the vertical axis c;
d = $\infty\breve{P}_2$, also somewhat striped parallel to c;
u = $\infty\breve{P}$, very narrow and imperfect;
k = oP, still more narrow and imperfect;
M = $\bar{P}\infty$, rough;
o = $\breve{P}\infty$, striped parallel to the brachy axis a.

Fluorite.

The occurrence of Fluorspar in the Melaphyre from Neuhaus has been mentioned by von Lasaulx[1]), but several new specimens coming from the same place in 1881 are perhaps worthy of a slight description. They occur in connection with Quartz, Calcite, Baryte and micalike Haematite. They are dull to emerald green in color and afford excellent examples of the building up of crystals from subindividuals. In structure they correspond closely with green Fluorspar from Kaltwasser near Breitenbrunn south of Schwarzenberg, Saxony. The cube, dodecahedron and a tetrakis hexahedron are more or less developed with lustrous faces on the sub-

[1]) Jahrb. für Min., 1877, 174; also Zeitschr. für Kryst. 1877, 1, 526.

individuals. The aggregate presents large but very rough octahedral faces and much less extended dodecahedral.

Zeolites.

These interesting minerals have long been collected from the loose pieces of Mandelstein scattered over Finkenhübel not far from Glatz. The list of those found there includes Laumontite, Chabasite, Stilbite (or Heulandite), Epistilbite, Desmine and Harmotome. Most of them have been described by Websky[1]) but require a brief mention here.

Laumontite occurs as white untransparent prisms ended by the plane — $P\overline{\infty}$. The front and rear edge of the prism is sometimes bevelled by a narrow plane. The prism faces have a pearly lustre, the end plane glass lustre. It is also found as a fibrous variety. It rests on Quartz and sometimes on other zeolites, e. g. Heulandite.

Chabasite is one of the more frequently found zeolites and shows the usual glasslike rhombohedra with striped planes. Twins with the chief axis as axis of rotation are common. One crystal shows the much rarer form in which the plane of symmetry is a rhombohedral face. Chabasite occurs also at Lomnitz.

Desmine is represented in the Breslau University collection by only two specimens from Silesian Melaphyre. They are small and rest on Quartz.

Harmotome is also represented by but two specimens. They are small, rest on Quartz and require no special notice.

Stilbite or Heulandite is by far the commonest of the zeolites. It has been found at Lomnitz and Goldspitz near Schönau as well as Finkenhübel. It appears generally as leafy masses filling or partly filling an amygdule, but quite frequently also as well developed crystals. The red variety is much less common than the pearly or white one. The planes P, M, N, T, z, (Naumann's letters) are often present.

[1]) Ueber Epistilbit und die mit ihm vorkommenden Zeolithe aus dem Mandelstein vom Finkenhübel bei Glatz, Zeitschr. d. d. g. Ges., 1869, **21**, 100.

Epistilbite, from the great rarity of the mineral, is the most interesting of the zeolites. Since Websky described them in 1869, two more crystals have reached the Museum. They are small, clear and fresh but unfortunately give but poor reflections. Still the largest one permitted the measurement of two angles with tolerable exactness, t t and M M. The planes observed are the prism M, the klinopinacoidal cleavage plane r; orthodoma t, and klinodoma s. The angle t t was found to be 112° 7′ 30″; M M gave 135° 14′ 30″. It may be of interest to compare these results with former ones. Those published are by Sartorius von Waltershausen[1]), Levy, G. Rose[2]), Websky and Tenne[3]), who all measured crystals from Berufjord, Iceland, except Websky who measured a fragment of a crystal from Finkenhübel. The measurements are as follows:

	Sart. v. W.	Levy[4])	G. Rose	Tenne	Websky[4])	Coleman
M : M =	135° 10′	135°50′-55′	135° 10′	133° 57′	133° 36′	135° 14′ 30″
t : t =	109° 13′		109° 46′	110° 47′ 30″		112° 7′ 30″

Among other minerals occurring in small amount may be mentioned Kaolin (Steinmark) from Buchberg as the filling of amygdules[5]), various oxides of iron, especially Göthite as slender needles at Buchberg and Finkenhübel, and Haematite in minute lamellae at Neuhaus.

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[1]) Pogg. Ann., **99**, 170.

[2]) Pogg. Ann. VI., 183.

[3]) Neues Jahrb. für Min. 1880, Bd. I, 43, Ueber Epistilbit.

[4]) Tenne in the Separat Abdruck aus dem Neuen Jahrb. p. 48, gives the results obtained by Levy and Websky reversed.

[5]) An analysis is published by Zöllner in Isis, 1834, Heft 6, 638:

Silica	49,2
Alumina	36,2
Ironoxide	0,5
Water	14,0
	99,9

LIFE.

I, Arthur P. Coleman, was born in the year 1852 in the Province of Quebec, Canada. In religion I am Evangelical. After preparation in various public schools, I spent two years in the Collegiate Institute of Cobourg (Canada) and was in 1872 admitted by matriculation into the University of Victoria College of the same town. Having completed a four years course I received in 1876 the degree of Bachelor of Arts with honors, and three years later, that of Master of Arts. On the advice of my loved and honored professor of Physics in that University, Dr. E. Haanel, who first gave my thoughts a decided impulse in the direction of science, I sailed for Germany and in the Autumn of 1880 was matriculated in the University of Breslau, where during four semesters I have heard lectures by Professors: Cohn, Dilthey, Goeppert, Liebisch, Loewig, Poleck, Roemer and Schneider. I enjoyed a semester's Botanical exercises with the microscope in Prof. Dr. F. Cohn's Institute and a semester's Zoological exercises with Prof. Dr. Schneider. A semester each was spent in Prof. Dr. Poleck's Chemical Laboratory and the one attached to the Mineralogical Museum. I have worked each semester in the Mineralogical and Palaeontological Collections of Geheimrath Professor Dr. Roemer. My special gratitude is due to Geheimrath Roemer for permission to use his splendid Collections and Library, as well as for his great kindness in other ways; to Prof. Dr. F. Cohn; and to Prof. Dr. Liebisch, whose thorough knowledge of Silesian Minerals and the literature connected with them were of very great assistance in the preparation of the foregoing Dissertation.

THESEN.

1. Die nordischen Diluvialerscheinungen Amerikas und Europas werden am besten durch die Gletschertheorie erklärt.
2. In der wissenschaftlichen Terminologie sollte man sich ausschliesslich griechischer oder lateinischer Wortstämme bedienen.
3. Die von Chr. S. Weiss eingeführten krystallographischen Axensysteme sind allen anderen vorzuziehen.

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1. The appearances of the Diluvium in the northern parts of America and Europe are best explained by the Glacier Theory.
2. The technical terms of Science should be formed exclusively from Greek or Latin roots.
3. The systems of crystallographic axes introduced by Chr. S. Weiss are preferable to all others.